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19 REPUBLIC OF FRANCE

NATIONAL INSTITUTE OF INDUSTRIAL PROPERTY

PARIS

11 Publication No.: 2 614 510
only to be used for ordering copies!

21 National registration No.: 87 06 157

51 IPC[illegible - 4?]: A 43 B 7/06.7/32

12 **PATENT APPLICATION**

22 Filing date: April 30, 1987

30 Priority:

43 Date application made available to the public: BOPI a Brevets [Fr. = Patent Journal] No. 44 of November 4, 1988

60 References to other related national documents:

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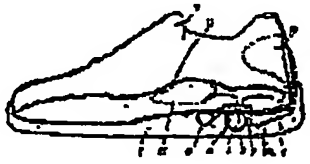
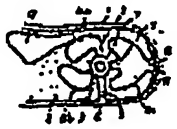
54 Sole Incorporating a Shoe Aeration Pump

57 The present invention is relative to a sole incorporating aeration pump 3 in the heel support zone.

In accordance with the invention pads 8 of a material with a greater compressibility than the mass of sole 2 are incorporated under the support surface located at the periphery of pump 3, compressible 8 pads are preferably divided into a plurality of independent volumes 8a, b, c in order to avoid transmitting the compression pressure among themselves and the plantar arch support also incorporates a pad 12 of a compressible material.

The invention increases the performance of the pump and improves the comfort of the shoe.





Sole Incorporating a Shoe Aeration Pump

Numerous patents such as FR-A-1,924,960; FR-A-854,986, etc. have already proposed incorporating a cavity into a sole which cavity delivers [forces], when the foot comes to be supported, a part of the volume of air which it contains to the upper [body] of the shoe and have proposed the intake of air, generally the ambient air, in order to fill the useful volume of the pump created when the foot is raised under the effect of the elasticity particular to the enclosed space constituting the pump, of the elasticity of the material constituting the sole in which said enclosed space in immersed or of springs provided in or around the pump.

The functioning of such a pump and its incorporation into a sole, realized in particular by molding a thermoplastic material or a synthetic rubber, pose technical problems. If the material constituting the sole is compressible and realized, e.g., in plastic foam, the sole will theoretically give way sufficiently under the effect of the pressure of the foot to permit an appreciable variation of volume of the cavity constituting the pump. However, such a sole does not assure, due to its significant compressibility, a sufficiently stable support for the foot and there is a risk of unsymmetrical compression with lateral tilting. Moreover, the cavity constituting the pump tends to widen out due to the pushing in of its lateral walls at the same time as it looses height in such a manner that its volume varies less than proportionally with its loss of height.

Probably having observed this phenomenon, US-A-3,225,463 proposed inserting into the layer of the sole located above the cavity an insert with the shape of a flattened dome with a flexibility substantially less than that of the layer over the cavity forming the pump and also to place a less flexible insert below this cavity which insert has the purpose of maintaining the cavity forming the pump in its original configuration. The solution of US-A-3,225,463 does not apply to a sole consisting of a relatively rigid material and the pumping volume is always defined by the reduction of thickness, under the pressure of the foot, of the mass of material constituting the sole.

The present invention has the problem of resolving the various problems cited above and encountered in soles incorporating a pumping cavity whose variation of volume under the pressure of the foot should be as great as possible.

Consequently, the invention has as subject matter a sole incorporating, in the heel support zone, a shoe aeration pump characterized in that pads of a material with a compressibility greater than the mass of the sole are incorporated under the support surface located at the periphery of the pump.

In the realization in conformity with the invention the degree of pushing in [down] of the upper wall delimiting the pump volume is a function of the compressibility of the pads and the pressure developed in their mass opposes a transversal dilatation of the enclosed space constituting the pump. In addition, since the material of the sole surrounding the pump

and the pads has a good dimensional stability under the pressure of a foot, it achieves a dimensional stability identical to that of classic soles and the pads are likewise kept from a lateral creeping that could cause a poor support of the foot.

According to a preferred embodiment the compressible pads are divided into a plurality of independent volumes in order to avoid transmitting the pressure of compression among themselves. This feature avoids a displacement of the compressible material constituting them from the most compressed zone in the direction of the less compressed zone with the resulting tilting of the part of the clean sole over the pump and the pads, which tilting reduces the comfort.

Due to the presence of the compressible pads in conformity with the invention, when the foot comes to be supported, the calcaneum [heel bone] comes to occupy a position several millimeters lower than that [which it would occupy] in a classic sole of the same material without compressible pads. If the sole comprises, as it often does, an inflated part forming a support for the plantar arch, this support of the plantar arch forms an abnormal, projecting swelling between the front and the back support zones of the foot and the result is an increased pressure under the metatarsal zone which reduces the comfort. In order to correct this and in conformity with the invention the plantar arch support also incorporates a pad of a compressible material.

According to a preferred embodiment the enclosed spaces constituting the pump and the compressible pads are integral with each other and form a single insert in order to facilitate their placing into the injection mold of the sole.

The enclosed spaces constituting the pads can be filled with compressible gas that can be incorporated in a foam. It is likewise possible to envisage filling them with a liquid or a gel; however, since these substances are incompressible the enclosed spaces forming the pads will then preferably communicate with an enclosed space not immersed in the sole, preferably enclosed spaces forming pockets housed in the part of the upper [the body] encasing the back part of the foot as described in patent FR-A-2,472,354 of the applicant. The sections for the passage of communication between chambers are sufficiently large to not brake the movement of the liquid or the gel.

The pump can be of any known type.

An exemplary realization of the invention is described below with reference made to the attached drawings.

Figure 1 is a view of a longitudinal section of the shoe.

Figure 2 is a plane view of the back part of the sole showing the arrangement of the pads.

Figure 3 is a view of a transversal section.

In the drawings reference numeral 1 designates the upper [the body of the shoe] and 2 the sole of injection-molded plastic material which material can be polyvinyl chloride, polyurethane, synthetic rubber, etc.

Central element 3 that is preferably in an approximately cylindrical shape and closed at its upper part by flexible, convex membrane 4 was placed into the mold before the injection in order to be immersed in the part of sole corresponding to the heel. This central element is connected to the outside of the sole by conduit 5 emptying by valve 6 provided or not provided with an obturating flap. This element 3 permits air to be drawn into the interior of the cavity and to be delivered [forced] to the interior of the upper, e.g., via orifice 7 obturated by a membrane (not shown) made of a material slightly permeable to air so as to permit the drawn-in air to diffuse equally in the interior of the shoe during walking.

Several pads 8 are located around the central element described above and are separated from the latter by means of tight partitions such as weldings 9. These pads form independent, tight chambers. Chambers 8a, 8b and 8c are located around central element 3 in such a manner that when pressed down under the force of the supporting of the heel they permit the upper part of central element 3 obturated by membrane 6 to be pushed in [down] in spite of the relative stability of form of sole unit 2.

In the embodiment shown, pads 8a and 8b are filled with a compressible gas and pad 8c with a liquid in order to simultaneously effect the object of FR-A-2,472,354. To this end pad 8c is connected by wide

conduit 10 to chamber 11 encasing the rear part of the foot. The liquid forced from chamber 8 inflates chamber 11, which keeps the heel, as disclosed in the above patent, encased in the heel counter [stiffening]. Obviously, chamber 8c could also be limited at the heel support surface and be filled with a compressible gas.

Pad 12 is also provided in plantar arch support 13 in order that the deformation by compression of this pad assures an elastic support of the plantar arch and avoids the appearance of a hard point under the metatarsus when central element 5 and pads 8 give way under compression.

CLAIMS:

1. A sole incorporating an aeration pump (3) of the shoe in the support zone of the heel, characterized in that pads (8) of a material with a greater compressibility than the mass of the sole (2) are incorporated under the support surface located at the periphery of the pump (3).

2. A sole according to claim 1, characterized in that the compressible pads (8) are divided into a plurality of independent volumes (8a, b, c) in order to avoid a transmission of the compression pressure between themselves.

3. A sole according to any one of claims 1 to 2, characterized in that the plantar arch support also incorporates a pad (12) of a compressible material.

4. A sole according to any one of claims 1 to 3, characterized in that the enclosed spaces constituting the pump (3) and the compressible pads (8) are integral in order to form a single insert.

5. A sole according to any one of claims 1 to 4, characterized in that the pads (8) are filled with a compressible gas.

6. A sole according to claim 5, characterized in that the compressible gas is incorporated in a foam.

7. A sole according to any one of claims 1 to 4, characterized in that some (8c) of the pads are filled with a non-compressible fluid and that the

enclosed space forming the pad communicates with an enclosed space (11) not immersed in the sole.

Fig: 1

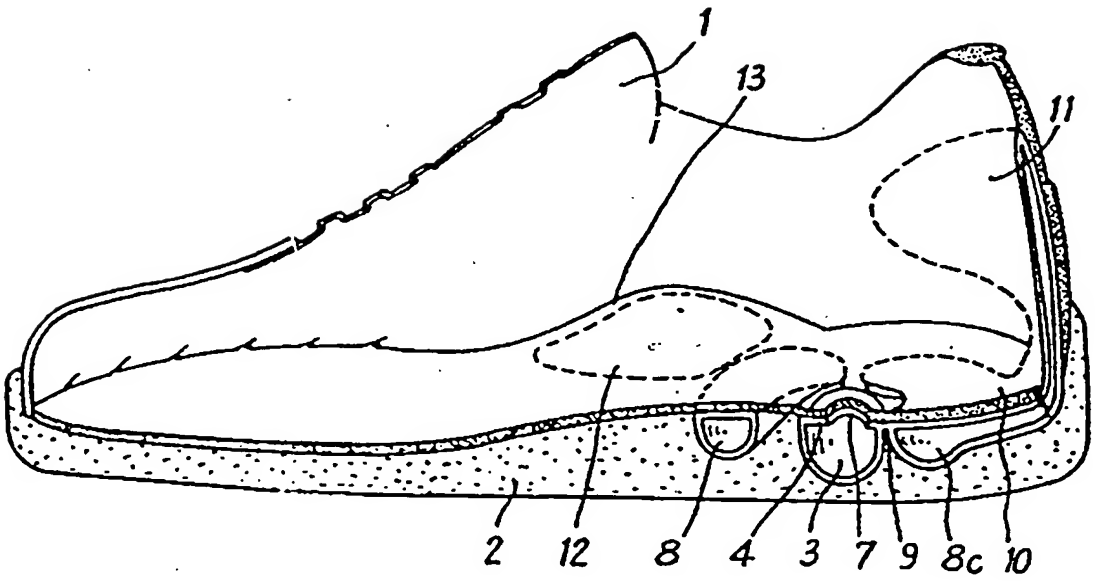


Fig: 3

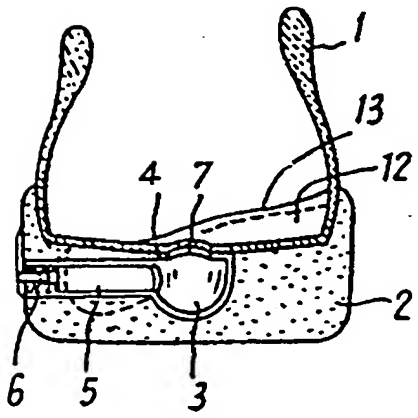


Fig: 2